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## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

PÖPPER, Evamaria  
Alstom (Schweiz) AG  
Intellectual Property CHSP  
Haselstrasse 16/699/5. OG  
CH-5400 Baden  
SUISSE

Date of mailing (day/month/year) 11 décembre 2001 (11.12.01)	<b>IMPORTANT NOTIFICATION</b>
Applicant's or agent's file reference 99/214 WO	
International application No. PCT/CH00/00493	International filing date (day/month/year) 13 septembre 2000 (13.09.00)

## 1. The following indications appeared on record concerning:

☒ the applicant
     
 ☐ the inventor
     
 ☐ the agent
     
 ☐ the common representative

## Name and Address

ALSTOM POWER N.V.  
Hullenbergweg 393-395  
NL-1101 Cs Amsterdam  
Netherlands

## State of Nationality

NL

## State of Residence

NL

Telephone No.

Facsimile No.

Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person
     
 ☐ the name
     
 ☐ the address
     
 ☐ the nationality
     
 ☐ the residence

## Name and Address

ALSTOM (SWITZERLAND) LTD.  
Haselstrasse 16  
CH-5401 Baden  
Switzerland

## State of Nationality

CH

## State of Residence

CH

Telephone No.

Facsimile No.

Teleprinter No.

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Catherine MASSETTI

Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

PÖPPER, Evamaria  
Alstom (Schweiz) AG  
Intellectual Property CHSP  
Haselstrasse 16/699/5. OG  
CH-5400 Baden  
SUISSE

Date of mailing (day/month/year) 11 June 2001 (11.06.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 99/214 WO	
International application No. PCT/CH00/00493	International filing date (day/month/year) 13 September 2000 (13.09.00)

## 1. The following indications appeared on record concerning:

☐ the applicant ☐ the inventor ☒ the agent ☐ the common representative

Name and Address ALSTOM POWER (SCHWEIZ) AG Haselstrasse 16 CH-5401 Baden Switzerland	State of Nationality	State of Residence
	Telephone No. +41 56 205 45 99	
	Facsimile No. +41 56 205 66 20	
	Teleprinter No.	

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address PÖPPER, Evamaria Alstom (Schweiz) AG Intellectual Property CHSP Haselstrasse 16/699/5. OG CH-5400 Baden Switzerland	State of Nationality	State of Residence
	Telephone No. +41 56 205 45 99	
	Facsimile No. +41 56 205 66 20	
	Teleprinter No.	

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned  
☐ the International Searching Authority ☒ the elected Offices concerned  
☒ the International Preliminary Examining Authority ☐ other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer A. Karkachi
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION CONCERNING  
SUBMISSION OR TRANSMITTAL  
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

ALSTOM POWER (SCHWEIZ) AG  
Haselstrasse 16  
CH-5401 Baden  
SUISSE

Date of mailing (day/month/year) 08 May 2001 (08.05.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 99/214 WO	
International application No. PCT/CH00/00493	International filing date (day/month/year) 13 September 2000 (13.09.00)
International publication date (day/month/year) 22 March 2001 (22.03.01)	Priority date (day/month/year) 16 September 1999 (16.09.99)
Applicant ALSTOM POWER N.V. et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(\*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
16 Sept 1999 (16.09.99)	99810828.6	EP	02 Apr 2001 (02.04.01) *

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. (41-22) 740.14.35	Authorized officer  F. Baechler  Telephone No. (41-22) 338.83.38
---	--

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 11 June 2001 (11.06.01)	
<b>International application No.</b> PCT/CH00/00493	<b>Applicant's or agent's file reference</b> 99/214 WO
<b>International filing date</b> (day/month/year) 13 September 2000 (13.09.00)	<b>Priority date</b> (day/month/year) 16 September 1999 (16.09.99)
<b>Applicant</b> TOQAN, Majed et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

31 March 2001 (31.03.01)

☐ in a notice effecting later election filed with the International Bureau on:
2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b> A. Karkachi Telephone No.: (41-22) 338.83.38
--	--

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 23 May 2001 (23.05.01)	
<b>International application No.</b> PCT/CH00/00493	<b>Applicant's or agent's file reference</b> 99/214 WO
<b>International filing date</b> (day/month/year) 13 September 2000 (13.09.00)	<b>Priority date</b> (day/month/year) 16 September 1999 (16.09.99)
<b>Applicant</b> TOQAN, Majed et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
 31 March 2001 (31.03.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b> Claudio Borton Telephone No.: (41-22) 338.83.38
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# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

# PCT

To:  
KLEIN, Ernest  
Sandstrasse 24  
5416 Kirchdorf  
SWITZERLAND

<b>CHSP</b> Eingang		Ablage: NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION	
11. JAN. 2001			
SB	Di	Pe	
Visa			

(PCT Rule 44.1)

Date of mailing (day/month/year)      20/12/2000	
Applicant's or agent's file reference 99/214 WO	<b>FOR FURTHER ACTION</b> See paragraphs 1 and 4 below
International application No. PCT/CH 00/ 00493	International filing date (day/month/year)      13/09/2000
Applicant  <b>"PATELHOLD" PATENTVERWERTUNGS- &amp; ELEKTRO-HOLDING A</b>	

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

**Where?** Directly to the      International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.


☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority  European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  <b>Véronique Baillou</b>
--	--

## NOTES FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

### INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

#### What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

#### When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

#### Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

#### How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

#### What documents must/may accompany the amendments?

##### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.



The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

**"Statement under article 19(1)" (Rule 46.4)**

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

**It must be in the language in which the international application is to be published.**

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

**Consequence if a demand for international preliminary examination has already been filed**

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

**Consequence with regard to translation of the international application for entry into the national phase**

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.



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2280 HV Rijswijk (ZH)  
☎ +31 70 340 2040  
TX 31851 epo nl  
FAX +31 70 340 3018

Europäisches  
Patentamt

Zweigstelle  
in Den Haag  
Recherchen-  
abteilung

European  
Patent Office

Branch at  
The Hague  
Search  
division

Office européen  
des brevets

Département à  
La Haye  
Division de la  
recherche

Klein, Ernest  
Sandstrasse 24  
5416 Kirchdorf AG  
SUISSE

Eingang  
20.03.00  
Xe

Datum/Date

16.03.00

Zeichen/Ref./Réf.

99/214 EP

Anmeldung Nr./Application No./Demande n°/Patent Nr./Patent No./Brevet n°.

99810828.6-2111-

Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire

"Patelhold" Patentverwertungs- & Elektro-Holding AG

## COMMUNICATION

The European Patent Office herewith transmits as an enclosure the European search report for the above-mentioned European patent application.

If applicable, copies of the documents cited in the European search report are attached.

☒ Additional set(s) of copies of the documents cited in the European search report is (are) enclosed as well.

The following specifications given by the applicant have been approved by the Search Division:

☒ abstract

☒ title

☐ The abstract was modified by the Search Division and the definitive text is attached to this communication.

The following figure will be published together with the abstract: NONE

## REFUND OF THE SEARCH FEE

If applicable under Article 10 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL7)
E	CH 689 830 A (LUZIUS ZAPPA) 15 December 1999 (1999-12-15) whole document	1	C04B7/45 F22B31/00
A	US 5 216 884 A (HOLSIEPE DIETMAR) 8 June 1993 (1993-06-08) * column 2, line 21 - column 4, line 10 *	1	
A	DATABASE WPI Section Ch, Week 199231 Derwent Publications Ltd., London, GB; Class L02, AN 1992-257351 XP002132235 & SU 1 675 254 A (CEMENT IND RES INST), 7 September 1991 (1991-09-07) * abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int. CL7)
			C04B
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 6 March 2000	Examiner Rauscher, M
<div>CATEGORY OF CITED DOCUMENTS</div> <div><div>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</div><div>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</div></div>			

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 99 81 0828

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-03-2000

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
CH 689830	A	15-12-1999	NONE	
US 5216884	A	08-06-1993	DE 4041251 A	25-06-1992
			CA 2056084 A	22-06-1992
			EP 0492133 A	01-07-1992
SU 1675254	A	07-09-1991	NONE	

Translation of the explanations of enclosure 2 of the search report of the European Patent Office ("Europäisches Patentamt") explaining the symbol letters stating the relevancy of the cited references:

### Explanations

Column 1: Category of Named Documents

- X: Reference which by itself is considered to have special significance
- Y: Reference which in combination with another reference in the same category is considered to have special significance
- A: Technological background
- O: Disclosure not in writing
- P: In-between literature
- T: Theories or principles basic to the invention
- E: Older patent document published on or after filing date
- D: Reference cited in the patent application
- L: Reference cited for other reasons
- &: Member of same patent family, corresponding document

Column 2: Identification of document, specifying the relevant portions, if necessary

Column 3: Concerned claims  
(In this column, the claims allocated to the relevant passages of column 2 are indicated.)

Column 4: Classification of Application (Int. Cl. 7)

Searched Fields (Int. Cl. 7)

# VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

Absender: ANMELDEAMT		<b>SLE-I</b> <small>Eingang</small> <b>19. SEP. 2000</b>		Ablage:		<h1 style="font-size: 2em; margin: 0;">PCT</h1>	
<b>An:</b>  <b>CHARGE</b>  Ernest Klein Sandstrasse 24 5416 Kirchdorf		SB <i>912</i> Visa <i>Eingang</i> <i>16.09.00</i> <i>6</i>		MITTEILUNG DES INTERNATIONALEN AKTENZEICHENS UND DES INTERNATIONALEN ANMELDEDATUMS  (Regel 20.5 c) PCT)			
		Absendedatum (Tag/Monat/Jahr) 14. September 2000 (14.09.00)					
		<b>WICHTIGE MITTEILUNG</b>					
Aktenzeichen des Anmelders oder Anwalts 99/214 WO							
Internationales Aktenzeichen PCT/CH 00/00493		Internationales Anmeldedatum (Tag/Monat/Jahr) 13. September 2000 (13.09.00)		Prioritätsdatum (Tag/Monat/Jahr) 16. September 1999 (16.09.99)			
Anmelder "Patelhold" Patentverwertungs- & Elektro-Holding AG, Glarus							
Bezeichnung der Erfindung Method of producing cement clinker and electricity.							
<ol style="list-style-type: none"> <li>1. Dem Anmelder wird mitgeteilt, dass der internationalen Anmeldung das oben genannte internationale Aktenzeichen und internationale Anmeldedatum zuerkannt worden ist</li> <li>2. Weiterhin wird dem Anmelder mitgeteilt, dass das Aktenexemplar der internationalen Anmeldung                         <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> dem Internationalen Büro am 15.09.00 übermittelt wird.  <input type="checkbox"/> dem Internationalen Büro noch nicht übermittelt wurde,  <div style="margin-left: 20px;"> <input type="checkbox"/> weil die erforderliche Überprüfung zum Schutz der nationalen Sicherheit noch nicht erfolgt ist.  <input type="checkbox"/> weil (Angabe des Grundes):                                 </div> </div> </li> </ol> <div style="margin-top: 20px;"> <input checked="" type="checkbox"/> Ein Exemplar dieser Mitteilung ist dem Internationalen Büro übersandt worden (da das Aktenexemplar dem Internationalen Büro noch nicht übermittelt wurde). *                     </div>							
<p>* Das Internationale Büro überwacht die Übermittlung des Aktenexemplars durch das Anmeldeamt und unterrichtet den Anmelder über dessen Eingang (mit Formblatt PCT/IB/301). Ist das Aktenexemplar bei Ablauf des vierzehnten Monats nach dem Prioritätsdatum noch nicht eingegangen, teilt das Internationale Büro dies dem Anmelder mit (Regel 22.1 c)).</p>							
Name und Postanschrift des Anmeldeamts  Eidgenössisches Institut für Geistiges Eigentum Einsteinstrasse 2, CH-3003 Bern Telefon +41 31 325 25 25 Fax +41 31 325 25 26 PC 30-4000-1				Bevollmächtigter Bediensteter  <div style="text-align: center; font-family: cursive; font-size: 1.2em;">O. Boedtker</div> Telefon +41 31 322 49 86 Olaf Boedtker			

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

PÖPPER, Evamaria  
Alstom (Schweiz) AG  
Intellectual Property CHSP  
Haselstrasse 16/699/5. OG  
CH-5400 Baden  
SUISSE

PC

19. Dez. 2001

MF

Date of mailing (day/month/year) 11 December 2001 (11.12.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 99/214 WO	
International application No. PCT/CH00/00493	International filing date (day/month/year) 13 September 2000 (13.09.00)

1. The following indications appeared on record concerning:

☒ the applicant    ☐ the inventor    ☐ the agent    ☐ the common representative

Name and Address ALSTOM POWER N.V. Hullenbergweg 393-395 NL-1101 Cs Amsterdam Netherlands	State of Nationality NL	State of Residence NL
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person    ☐ the name    ☐ the address    ☒ the nationality    ☒ the residence

Name and Address ALSTOM (SWITZERLAND) LTD. Haselstrasse 16 CH-5401 Baden Switzerland	State of Nationality CH	State of Residence CH
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office    ☐ the designated Offices concerned  
☐ the International Searching Authority    ☒ the elected Offices concerned  
☐ the International Preliminary Examining Authority    ☐ other:

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Catherine MASSETT</p> <p>Telephone No.: (41-22) 338.83.38</p>
--	--

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF RECEIPT OF  
RECORD COPY

(PCT Rule 24.2(a))

From the INTERNATIONAL BUREAU

To:

KLEIN, Ernest  
Sandstrasse 24  
CH-5416 Kirchdorf  
SUISSE

Date of mailing (day/month/year) 18 October 2000 (18.10.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 99/214 WO	International application No. PCT/CH00/00493

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

"PATELHOLD" PATENTVERWERTUNGS- & ELEKTRO-HOLDING AG (for all designated States except US)

TOQAN, Majed et al (for US)

International filing date : 13 September 2000 (13.09.00)

Priority date(s) claimed : 16 September 1999 (16.09.99)

Date of receipt of the record copy by the International Bureau : 19 September 2000 (19.09.00)

List of designated Offices :

AP : GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZW

EA : AM,AZ,BY,KG,KZ,MD,RU,TJ,TM

EP : AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE

OA : BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG

National : AE,AG,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EE,

ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MA,

MD,MG,MK,MN,MW,MX,MZ,NO,NZ,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,US,

UZ,VN,YU,ZA,ZW

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

S. De Michiel

Telephone No. (41-22) 338.83.38



# PATENT COOPERATION TREATY

**PCT**

## NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

ALSTOM POWER (SCHWEIZ) AG  
Haselstrasse 16  
CH-5401 Baden  
SUISSE

STAMP	Eingang	Abgabe:
05. FEB. 2001		
SB		
Visa		

<b>Date of mailing (day/month/year)</b> 24 January 2001 (24.01.01)	<b>Applicant's or agent's file reference</b> 99/214 WO
<b>International application No.</b> PCT/CH00/00493	<b>International filing date (day/month/year)</b> 13 September 2000 (13.09.00)

**IMPORTANT NOTIFICATION**

<b>1. The following indications appeared on record concerning:</b> <input checked="" type="checkbox"/> the applicant <input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative			
<b>Name and Address</b> "PATELHOLD" PATENTVERWERTUNGS- & ELEKTRO-HOLDING AG Brunner, Kurt Bankstrasse 21 CH-8750 Glarus Switzerland	<b>State of Nationality</b> CH	<b>State of Residence</b> CH	<b>Telephone No.</b>  <b>Facsimile No.</b>  <b>Teleprinter No.</b>  
<b>2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:</b> <input checked="" type="checkbox"/> the person <input type="checkbox"/> the name <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence			
<b>Name and Address</b> ALSTOM POWER N.V. Hullenbergweg 393-395 NL-1101 Cs Amsterdam Netherlands	<b>State of Nationality</b> NL	<b>State of Residence</b> NL	<b>Telephone No.</b>  <b>Facsimile No.</b>  <b>Teleprinter No.</b>  
<b>3. Further observations, if necessary:</b>  			
<b>4. A copy of this notification has been sent to:</b> <div style="display: flex; justify-content: space-between;"> <div> <input checked="" type="checkbox"/> the receiving Office  <input type="checkbox"/> the International Searching Authority  <input type="checkbox"/> the International Preliminary Examining Authority                         </div> <div> <input type="checkbox"/> the designated Offices concerned  <input type="checkbox"/> the elected Offices concerned  <input type="checkbox"/> other:                         </div> </div>			

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b>  S. De Michiel  Telephone No.: (41-22) 398.83.38
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CHSP	Eingang	Ablage:
22. JUNI 2001		PATENT COOPERATION TREAT
SB		
Visa	117	PCT

**INFORMATION CONCERNING ELECTED  
OFFICES NOTIFIED OF THEIR ELECTION**

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

PÖPPER, Evamaria  
Alstom (Schweiz) AG  
Intellectual Property CHSP  
Haselstrasse 16/699/5. OG  
CH-5400 Baden  
SUISSE

Date of mailing (day/month/year) 11 June 2001 (11.06.01)		
Applicant's or agent's file reference 99/214 WO		IMPORTANT INFORMATION
International application No. PCT/CH00/00493	International filing date (day/month/year) 13 September 2000 (13.09.00)	Priority date (day/month/year) 16 September 1999 (16.09.99)
Applicant ALSTOM POWER N.V. et al		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE  
National : AU, BG, CA, CN, CZ, DE, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

AP : GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW  
EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM  
OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG  
National : AE, AG, AL, AM, AT, AZ, BA, BB, BR, BY, BZ, CH, CR, CU, DK, DM, DZ, EE, ES, FI, GB,  
GD, GE, GH, GM, HR, HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MW,  
MX, MZ, PT, SD, SG, SI, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

3. The applicant is reminded that he must enter the "national phase" **before the expiration of 30 months from the priority date** before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed **until 31 months from the priority date** for all States designated for the purposes of obtaining a European patent.

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. (41-22) 740.14.35</p>	<p>Authorized officer: A. Karkachi</p> <p>Telephone No. (41-22) 338.83.38</p>
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REC'D 21 MAY 2001

WIPO

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 99/214 WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/CH00/00493	International filing date (day/month/year) 13/09/2000	Priority date (day/month/year) 16/09/1999
International Patent Classification (IPC) or national classification and IPC C04B7/45		
Applicant ALSTOM POWER N.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.  
  
☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  31/03/2001	Date of completion of this report  17.05.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Rauscher, M  Telephone No. +49 89 2399 8566  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CH00/00493

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-15 as originally filed

**Claims, No.:**

1-15 as originally filed

**Drawings, sheets:**

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/CH00/00493

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims 1-15
	No: Claims
Inventive step (IS)	Yes: Claims 1-15
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-15
	No: Claims

2. Citations and explanations  
**see separate sheet**

AS TO SECTION V:

1. The following documents have been considered:

D1: US-A-5 216 884 (HOLSIEPE DIETMAR) 8 June 1993 (1993-06-08)

D2: DATABASE WPI Section Ch, Week 199231 Derwent Publications Ltd.,  
London, GB; Class L02, AN 1992-257351 XP002132235 & SU 1 675 254 A  
(CEMENT IND RES INST), 7 September 1991 (1991-09-07)

D1 and D2 disclose plants for producing simultaneously both, cement clinker and electricity. The calcining and pre-heating system is operated in the form of fluidised beds. No emphasis is put on the way in which fly ash formed in the calcinator is processed.

2. In accordance with the present application fly ash leaving the fluidised bed reactor is separated from coarser particles. This is effected by allowing the fly ash to escape from the cyclone system with the flue gas whilst the coarser particles are collected and recycled to the fluidised bed.

This features install novelty over either D1 or D2.

3. It has been made plausible that a number of advantages are attributable to the said features.

Thus the requirements of the cyclone system are reduced and so are reduced investments and demand of energy.

Moreover the stream of recycled product which is returned to the fluidised bed may be handled more easily.

These technical effects are accepted for acknowledging an inventive step.

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Dr. PöPPER, E.  
ALSTOM (SCHWEIZ) AG  
Haselstrasse 16  
CH-5400 Baden  
SUISSE

CHSP	Eingang	Ablag :
21	MAY 2001	99/214 WO
SB	Pe	
Visa	PCT Pe 25.05.01	

## NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Rule 71.1)

Date of mailing  
(day/month/year) 17.05.2001

Applicant's or agent's file reference  
99/214 WO

### IMPORTANT NOTIFICATION

International application No.  
PCT/CH00/00493

International filing date (day/month/year)  
13/09/2000

Priority date (day/month/year)  
16/09/1999

Applicant  
ALSTOM POWER N.V. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
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Authorized officer

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(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
22 March 2001 (22.03.2001)

PCT

(10) International Publication Number  
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(51) International Patent Classification<sup>7</sup>: C04B 7/45,  
F22B 31/00

(21) International Application Number: PCT/CH00/00493

(22) International Filing Date:  
13 September 2000 (13.09.2000)

(25) Filing Language: English

(26) Publication Language: English

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99810828.6 16 September 1999 (16.09.1999) EP

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STOM POWER N.V. [NL/NL]; Hullenbergweg 393-395,  
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(74) Agent: ALSTOM POWER (SCHWEIZ) AG; Hasel-  
strasse 16, CH-5401 Baden (CH).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,  
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,  
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,  
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,  
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,  
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

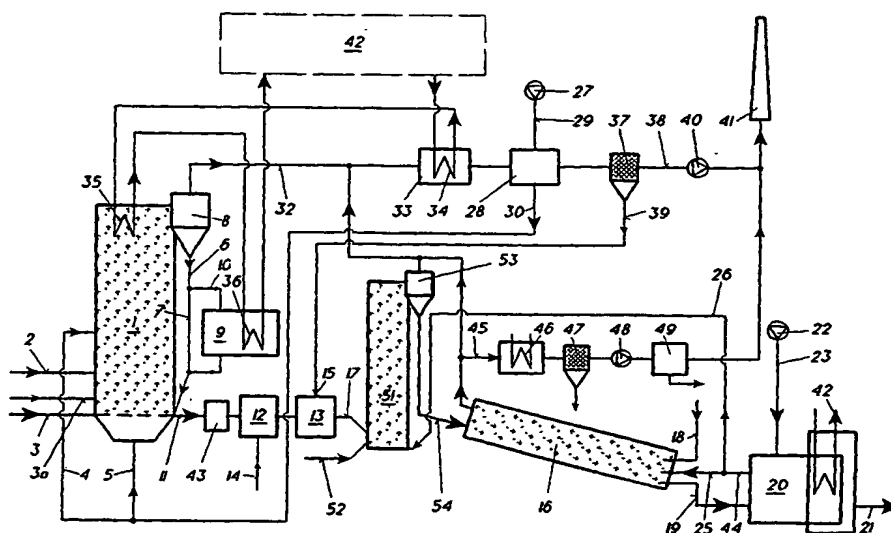
(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,  
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

[Continued on next page]

(54) Title: METHOD OF PRODUCING CEMENT CLINKER AND ELECTRICITY



(57) Abstract: In a method of producing cement clinker and electricity, cement raw mix and hydrocarbon are fed in a circulating fluidized bed boiler (1). Therein cement raw mix is calcined and steam is produced. Gas and solids out of the fluidized bed enter a cyclone (8), the solids being separated therein and returned to the bed. Part of those solids are first cooled down in a solids heat exchanger (9) producing steam. Fly ash consisting predominantly of lime and gas escaping the cyclone are passed through a heat exchanger (28, 33) and a filter (37). Hot bed material is discharged from the circulating fluidized bed and is ground with additives, then blended with lime being separated in the filter (37), then supplied to a rotary kiln (16), wherein the solids are clinkered. The produced steam is fed to a steam turbine island (42).

WO 01/19750 A1





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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## **Method of producing cement clinker and electricity**

### **Field of the invention**

The invention relates to a method of producing cement clinker and electricity, comprising feeding cement raw mix and hydrocarbon in a circulating fluidized bed, calcining the cement raw mix in the circulating fluidized bed and producing steam therein, discharging hot bed material in a rotary kiln, clinkering the calcined material in the rotary kiln and subsequently cooling the clinker, further comprising the gas and the solids out of the fluidized bed entering a cyclone, the solids being separated therein being returned to the bed, whereby part of those solids being first cooled down in a solids heat exchanger producing steam, whereas the gas and the fly ash escaping the cyclone being passed through at least one heat exchanger and through a filter, further comprising the produced steam being fed to a steam turbine island comprising a steam turbine being drivingly connected to a generator.

## Discussion of Background

U.S. Patent 4,425,163 describes a method for producing cement clinker, in which raw cement powder is calcined to a level of at least 95% in a circulating fluidized bed and then clinkered in a rotary kiln. The circulation system comprises a fluidized bed reactor, a cyclone separator and a recycling duct. The carbonaceous fuel supplied to the calcining fluidized bed reactor is burnt near stoichiometrically in two stages with fluidizing gas and secondary gas. This method requires a preheating of the raw material in a suspension type heat exchanger.

A method of producing cement clinker and electricity as described above in the „field of the invention“ is known from the article „Challenges of circulating fluid bed reactors in energy and raw material industries“ by Lothar Reh, published in DECHEMA Deutsche Gesellschaft für chemisches Apparatewesen, Chemische Technik und Biotechnologie e.V., Frankfurt am Main. This article is based on a lecture held on the 6th International Conference on Circulating Fluidized Beds, in Würzburg, Germany on August 22-27, 1999. This article describes trigeneration of cement, electricity and heat from high-ash coal using Circulating Fluidized Bed-Technology. Limestone and high-ash coal are separately prepared and ground before feeding them into the boiler. These two basic raw materials are proportioned online. Sulfur is completely bound into the bed material, which has the chemical composition of clinker. The hot bed material is discharged directly into a small rotary kiln. This direct use of ash substituting the clay component in cement avoids disposal of ash completely. This known method requires high performance cyclones in order to catch and recycle the pulverized limestone and/or lime and the grinding of the high-ash coal prior to its entry in the boiler.

### Summary of the invention

Accordingly, the object of the invention is to provide a novel method and plant for integrating a cement clinker-burning unit into a hydrocarbon, especially coal-fired power plant, using circulating fluidized bed technology.

This is achieved, according to the invention, by following means

- feeding part of the cement raw mix in pulverized form,
- designing the cyclone system so as the lime-rich fly ash obtained from calcination of limestone from the pulverized part of the cement raw mix escapes the cyclone system,
- feeding the predominant part of the remaining part of the cement raw mix in crushed form for forming bed and circulating material,
- and grinding the hot bed material as well as additives before blending them with lime being separated in the filter, obtained from calcination of limestone in the cement raw mix.

The advantages of the invention are to be seen in a significantly smaller number of cyclones leading to lower capital cost, because the cyclone system may have a larger cut size than the above mentioned prior art devices. It has a lower pressure drop, which leads to lower power consumption and lower operation cost. It also has a higher reliability due to the absence of fines in the material collected in the cyclone, which becomes easier to discharge. Another advantage is seen in the fact that there is no need to grind the fuel feed. Lastly the nitric oxide emissions are lower.

The discharged hot bed material may be cooled before grinding. This allows reliable operation of the downstream grinding equipment and gives an opportunity for further steam production.

The heat exchanger cooling the flue gas and the fly ash may be completely utilized for preheating air that is fed to the bed as fluidizing and overbed air. This requires only one piece of equipment, resulting in a high temperature driving force for steam generation in the remainder of the system. Another advantage is the short residence time of the gases and the fly ash in the heat exchanging apparatus, thus avoiding recarbonation of the lime to  $\text{CaCO}_3$ .

The at least one heat exchanger may also be a steam producer followed by the air heater. In this case, it is preferable to cool the gas and the fly ash escaping the cyclone and entering the steam producer at a fast rate in order to avoid recarbonation.

### **Brief description of the invention**

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing, which illustrates diagrammatically an exemplary embodiment of the invention with coal as hydrocarbon. Only the elements essential for understanding the invention are shown. Arrows illustrate the flow direction of the working media.

### **Description of the preferred embodiment**

Referring now to the drawing, the equipment necessary for performing the cement and electricity production consists mainly of a circulating fluidized bed reactor 1, called hereafter CFB, a cement plant and a steam turbine island 42.

The equipment necessary for performing the cement production comprises mainly three blocks, namely the same CFB acting as a raw mix preheater and calciner, a kiln 16 and a clinker cooler 20. The basic idea is to have used the circulating fluidized bed combustor as steam boiler and as calciner for the cement raw mix.

- Regarding the preheating of the air needed for cooling the cement clinker, for clinkering the cement raw mix, and for oxidizing the hydrocarbon, which is coal in this embodiment.

Via air intake line 23, ambient air is sucked in the system by a fan 22 to a clinker cooler 20 and heated therein by cooling down the cement clinker. The heated air exits the clinker cooler via line 44. This air is now divided into two streams. A first stream is supplied to the kiln 16 via line 25 as kiln combustion air. The second stream bypasses the kiln via line 26 and is fed into a riser tube 51 for combustion of fuel to preheat the cement raw mix.

Via air intake line 29 the major portion of ambient air is sucked by a fan 27 in the system. This air is preheated in an air preheater 28, which might be of the Ljungström-type. Via line 30 the air is fed to the combustor 1, in which it penetrates via a fluidizing air supply 5 and a secondary or overbed air supply 4.

- Regarding the „steam“ production

Depending on the apparatus type, the gas/air mixture can be introduced into the combustor on different levels. In the example shown on the drawing, in which the reactor is an upright circulating fluidized-bed steam generator with a flow stream from bottom to top, the fluidizing air is introduced at the bottom through an air distributor. The secondary air is fed through one or more elevations of ports in the lower combustor. The reactor is provided with four other inlets. One carbonaceous residue supply line 6, one inlet 2 for the coal and two inlets 3 and 3a for the raw cement mix.

Coal (and sorbent) is introduced mechanically or pneumatically to the lower portion of the reactor via supply 2. This coal can be either crushed or pulverized. Like the air, coal may be injected on different levels of the reactor. If the coal is in form of crushed material with a size of approximately 6-mm, it can be fed by gravity.

Combustion takes place throughout the combustor, which is filled by bed material. Flue gas and entrained solids leave the combustor and enter one or more cyclones 8, where the solids are separated.

The flue gas and the fly ash exit the gas outlet of the separation device 8 via a flue gas line 32. These separated gases are further treated before disposal. They are first cooled down in a gas cooler 33, thereby heating up water in an economizer 34 integrated in the water/steam cycle of a steam turbine island 42. In order to avoid recarbonation of the lime, the gases in line 32 are cooled at a fast rate, i.e. greater than 30°C/sec. Downstream the gases are further cooled in the air preheater 28. The gas is supposed to leave this gas cooler 28 with a temperature of about 100-150°C. Downstream the gas cooler a solids filter 37 is provided in the line 38 to remove from the gas all the remaining solids. This filter 37 could be a fabric filter or an electrostatic precipitator. A fan 40 is installed in the gas line exiting the filter, preferably on the clean side of the filter 37. Its purpose is to control the pressure in the system close to atmospheric conditions. The cleaned gas leaves the system via the stack 41. The solids separated in the filter 37 are a major feature of the invention. They are fed via line 39 to an appropriate location in the cement system.

The solids separated in the cyclone 8 are recycled to the combustor via line 6. The major portion is directly returned to the fluidizing bed via line 7. Some solid is diverted via line 10 to an external fluidized-bed heat exchanger 9 and then

added to the portion in line 7. The bed temperature in the combustor 1 is essentially uniform and is maintained at an optimum level for sulfur capture and combustion efficiency by heat absorption in the walls of the combustor. In the present example the heat exchange is supposed to occur in an evaporator 35. Superheating of the steam and - for large steam turbine units with a reheat cycle - reheating is performed preferably by further heat removal from the hot solids absorption in the fluidized-bed heat exchanger 9 and/or in the gas-cooler 33. This heat exchanger 9 is containing immersed tube bundles. The flow rate of the solids through apparatus 9 via line 10 can be used to control the steam temperature. The produced superheated steam is fed to the turbine island 42 comprising at least one steam turbine driving a generator producing electrical power. Additional steam is produced for the turbine in the clinker cooler 20 from cooling the hot clinker discharged from the kiln 16 via line 19.

Sulfur compounds in the fuel or in the cement raw materials are mainly released in the CFB reactor 1 as  $\text{SO}_2$ . In traditional CFB steam production units, the amount of limestone needs to be minimized - Ca/S molar ratio typically around 2 - to minimize operating costs. In the present method, Ca/S molar ratios greater than 3 can be used in the CFB to improve the sulfur capture from flue gas exiting the system via stack 41. No attendant increase in operating costs results since a very high amount of calcium relative to sulfur is inherent in the cement clinker making process. A very high sulfur removal efficiency (greater than 98%) in the flue gases in line 38 can also be achieved by re-injecting a portion of the lime-rich solids 39 into the flue gas leading to the filter 37 and by simultaneously controlling the relative humidity in the flue gas by moisture addition or temperature control. This might be necessary for high-sulfur fuels, where the portion of the sulfur in the cement raw mix released in kiln 16 and carried back to boiler flue gas 32 may be significant.



- Regarding the cement production

A major feature of the invention is the integrated coproduction of power and cement, in which coproduction the ashes of the power production are used to replace part of the cement raw mix in the cement production. Indeed coal ashes are similar in composition to calcined clays. Moreover all of the coal residues are converted into cement, the sulfur is absorbed by clinker component CaO.

As described above, two inlets 3 and 3a for the raw cement mix are provided in the reactor 1. Via line 3, a part of limestone is fed into the reactor in pulverized form; typically 90% of the limestone particles are smaller than 90 microns, the size being appropriate for the cement clinkering process. Via line 3a the remaining part of crushed limestone is introduced to form bed and circulating material. At temperatures above about 800°C, limestone  $\text{CaCO}_3$  is calcined into CaO. CaO combines with  $\text{SO}_2$  released from coal combustion and oxygen to form gypsum  $\text{CaSO}_4$ .  $\text{SO}_2$  can be disposed by standard wet or dry scrubbing methods using limestone. Enhanced dry scrubbing methods are included such as hydrating the calcined lime before introduction into the low temperature  $\text{SO}_2$ -laden flue gas stream and/or recirculating the calcium-rich solids from the filter back into the duct leading to the filter 37 and/or cooling the flue gas stream leading to the filter 37.

Draining off solids controls solids inventory in the combustor. The hot solids drained of the fluidizing bed via line 11 are cooled down through an ash cooler 43. They are introduced in a grinder 12 in which they are ground to an extent that 90% are below 90  $\mu\text{m}$ . They are mixed with additives introduced in the grinder by a line 14 and with some of the cement raw mix (not shown). These corrective additives are used, if any essential chemical compound needed in the mixture of coal ash and limestone like iron oxide or silica content are not present in the required amount.

The ground material is supplied to a blender 15, in which is added the lime  $\text{CaO}$  via a supply 15. This amount of lime is constituted by the solids separated in the filter 37 and is fed via line 39. To achieve this amount of lime coming from filter 37, the cyclone 8 is designed to separate the predominant char and crushed cement material from the remaining components. Since the mean size of the ash and the lime is typically smaller than  $50\mu\text{m}$  it will escape the cyclone, while the char and the crushed lime/limestone, which is far greater in size will be retained in the cyclone. Thus the fly ash escaping the cyclone consists predominantly of lime and is forwarded with the flue gas in line 32.

In a preferred embodiment, the calcined raw mix may be preheated after the blender 13 before introduction into the kiln 16. This allows decreasing the size of the kiln 16. The calcined raw mix of the correct size and composition for cement clinker making is then introduced into a riser tube 51 via line 17. To increase the cement raw mix temperature, a small amount of fuel is fired in the riser tube 51 along with preheated air coming from line 26 out of the clinker cooler 20. The fuel is supplied via a line 52. At its exit the tube connects the kiln exit and a cyclone 53. The cyclone 53 discharges the heated cement raw mix via line 54 into the kiln 16.

The gases leaving the cyclone 53 are mixed into line 32 with the flue gases leaving the CFB cyclone 8. Since the kiln 16 is typically operated under slightly negative pressure to avoid leakage of hot gases into the environment and since the inlet air for the CFB is required to be under positive pressure to overcome the pressure drop in the bed and freeboard, the kiln exhaust cannot be ducted to the CFB inlet. Instead, the kiln exhaust is added to flue gases leaving the CFB cyclone 8, where the pressure levels are compatible.

In the rotary kiln 16, the preheated and calcined raw mix is burnt into cement clinker. For combustion in the kiln 16, a small amount of fuel, i.e. coal is injected via a lance 18 together with the preheated air in line 25. The cement clinker - in form of nodules - is then forwarded via line 19 into a cement cooler 20, which might be a moving grate. Besides air preheating, in the present example is also shown steam production in the cement cooler. This steam may be injected in an appropriate location in the steam turbine island 42. The cooled clinker nodules are finally supplied to a cement grinder, which is not shown.

When using high sulfur fuels, a portion of the sulfur captured by the lime in the CFB reactor 1 would be released in the kiln 16 due to the high processing temperatures. It might also be necessary to control the sulfur content of the clinker to below a certain value (typically 2.5 to 3 %  $\text{SO}_3$ ) to obtain acceptable clinker quality. An acceptable sulfur content in the clinker can be achieved, for example, by controlling the level of oxidizing conditions in the kiln, with the  $\text{SO}_2$  being released into the flue gas leaving the kiln. The flue gas stream exiting the kiln 16, relatively concentrated in  $\text{SO}_2$ , can be cost-effectively treated by taking a portion of it and cleaning it in a wet limestone scrubber to a valuable product gypsum, which can be added to the final cement product.

A bypass flue gas line 45 is connected to a flue gas cooler 46 and a filter 47. This filter could be an electrostatic precipitator wherein the entrained particles are separated, the coarse particles being returned to the process and the fine particles being separately disposed. A fan 48 and a limestone scrubber 49 follow the electrostatic precipitator downstream. The gas exit of the scrubber is connected to stack 11. Combining  $\text{CaCO}_3$  with  $\text{SO}_2$  and oxygen form gypsum  $\text{CaSO}_4$  in the limestone scrubber. This gypsum can be used as an additive to ground clinker in the final cement product.

The invention may be illustrated in more detail with reference to a numerical example: it goes without saying that absolute values cannot be specified in connection with the said numerical values with regard to the dimensioning of the involved apparatus, since absolute values are in any case not meaningful enough on account of their dependence on numerous parameters.

For obtaining an electrical output of 220 MW and a cement output of 35 kg/sec, a total airflow of 233 kg/sec, coal in the amount of 23.3 kg/sec, limestone in the amount of 43 kg/sec and 8 kg/sec additives are needed. A higher ash coal will typically require fewer amounts of additives

220 kg/s of ambient air is sucked in by fan 27 to the air preheater 28 and is heated therein to 350°C. 12 kg/s of ambient air is sucked in by fan 22 into the clinker cooler. The air leaves the cooler at around 1100°C. The remainder of the cooling of the clinker nodules down to around 100°C is accompanied with steam production for the turbine. From the air leaving the cooler, 3 kg/s are fed to the kiln via line 25 and 9 kg/s are bypassing the kiln via line 24 into the riser tube 51. The gas amount out of the kiln is about 4,4 kg/s at 1100°C. The total gas leaving the cyclone 53 is 14.3 kg/s and is combined with the flue gas leaving the CFB cyclone 8. The fluidizing air fed to the bed bottom via supply 5 is in the amount of 110 kg/s and the overbed air via supply 4 is in the amount of 110 kg/s. The flue gas in line 45 is in the amount of 1.0 kg/s at 1100°C. The temperature after the cooler 46 is 150°C.

Coal in the amount of 22 kg/s is injected in the CFB reactor 1 and in the amount of 0.4 kg/s is injected into the kiln 16. The latter is transported with 1 kg/s of primary air. Another 0.9 kg/s is injected in the riser tube 51. Pulverized limestone in the amount of 39 kg/sec and crushed limestone in the amount of 4 kg/sec are introduced in the reactor 1. In the fluidized bed reactor 2500-4000 kg/sec are typically circulated. The bed drain of the reactor is at about 3 kg/sec,

the additives introduced in grinder 12 are at about 8 kg/sec and the lime separated in filter 37 and fed to blender 13 is in the amount of 24 kg/sec. Thus 35 kg/sec of calcined raw mix are supplied to the kiln.

The hot solids of the bed drain are cooled down in apparatus 42 to around 200°C. The gas and the solids exiting the reactor and entering the cyclone 8 have a temperature between 800 and 1200°C. An amount of 85% of the hot solids out of the cyclone 8 is returned uncooled to the reactor 1, while 15% are supplied to the fluidized bed heat exchanger 9 and cooled down therein to ca. 400°C. Of course this temperature depends on the amount of heat extracted for steam superheating or reheating.

Downstream the cyclone 8, the escaped gas is in the amount of 275 kg/sec and the escaped fly ash is in the amount of 24 kg/sec. In the example shown, the gas and the fly ash are cooled down in the steam heat exchanger 33 to 350°C and further in the air cooler 28 to 100°C.

It might be that about 0.5 kg/s carbon is contained in the fly ash. This carbon is separated in the filter 37 with the lime and fed to the kiln. In this case either the coal amount to the kiln has to be reduced appropriately or the amount of air through the kiln has to be augmented to burn the supplemental 0.5 kg/sec carbon.

Of course, the invention is not restricted to the plant shown and described. The invention can be used irrespective of the type and design of the combustor. This combustor could as well be an apparatus with entrained flow, if a pulverized fuel is used. Instead of cyclones, separating apparatus with moving bed could be used as well. A larger air cooler could replace the steam heat exchanger 33 and the air cooler 28. This would preheat the air in line 29/30 to about 750°C and provide a high temperature driving force for steam generation

in apparatus 35 and 36. It is understood that – depending on the amount of heat being available and being extracted - preheating, evaporating, superheating and reheating may occur in all apparatus 34, 35 and 36 and in the clinker cooler 20.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

## List of Designations

- 1 circulating fluidized bed
- 2 hydrocarbon feed line
- 3, 3a limestone feed line
- 4 secondary (overbed) air line to 1
- 5 fluidizing air supply
- 6 solids return line
- 7 solids return line bypassing 9
- 8 cyclone
- 9 fluidized bed heat exchanger
- 10 solids return line to 9
- 11 hot bed material discharge
- 12 grinder
- 13 blender
- 14 additive supply to 12
- 15 lime supply to 13
- 16 kiln
- 17 calcined material line to 51
- 18 fuel supply to 16, coal
- 19 kiln clinker discharge line, nodules
- 20 clinker cooler
- 21 line to clinker grinder
- 22 fan
- 23 air supply to 20
- 25 air supply to 16
- 26 air line bypassing kiln 16
- 27 fan
- 28 air heater
- 29 air supply to air heater
- 30 hot air discharge from air heater, air supply to 1
- 32 gas and fly ash line
- 33 steam heat exchanger
- 34 economizer
- 35 evaporator
- 36 superheater and reheater
- 37 filter, electrostatic precipitator
- 38 gas exhaust line
- 39 lime discharge line from 37
- 40 fan

- 41 stack
- 42 steam turbine island
- 43 hot solids cooler
- 44 second air discharge from 20
- 45 bypass flue gas from kiln 16
- 46 flue gas cooler
- 47 filter
- 48 fan
- 49 limestone scrubber
- 51 riser tube
- 52 coal supply to 51
- 53 cyclone of 51
- 54 calcined material line to 16

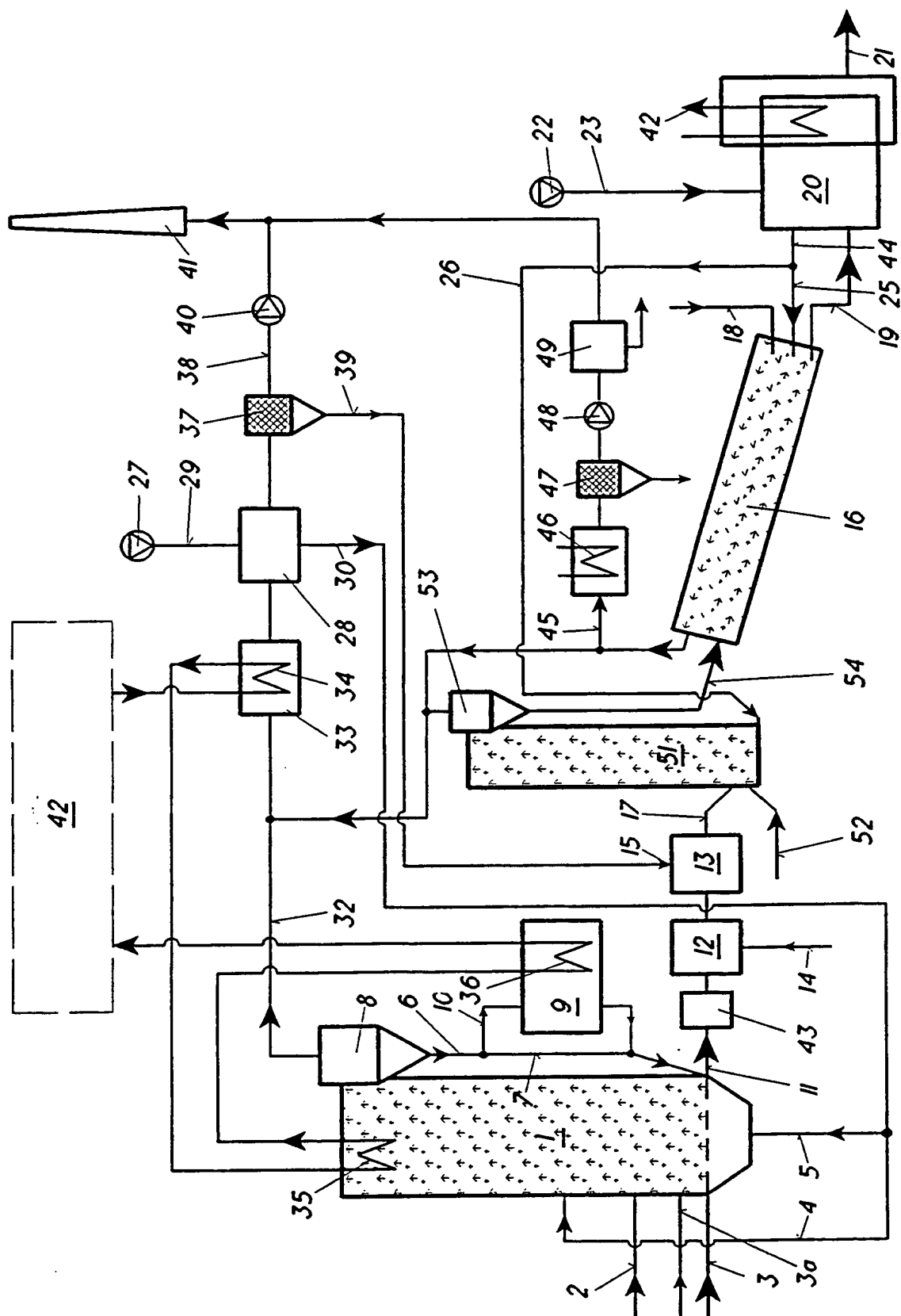


### Claims

1. In a method of producing cement clinker and electricity, comprising feeding cement raw mix and hydrocarbon in a circulating fluidized bed (1), calcining the cement raw mix in the circulating fluidized bed and producing steam therein, discharging hot bed material in a rotary kiln (16), clinkering the calcined material in the rotary kiln and subsequently cooling the clinker, further comprising the gas and the solids out of the fluidized bed entering a cyclone (8), the solids being separated therein being returned to the bed, whereby part of those solids being first cooled down in a solids heat exchanger (9) producing steam, whereas the gas and the fly ash escaping the cyclone being passed through at least one heat exchanger (28, 33) and through a filter (37), further comprising the produced steam being fed to a steam turbine island (42) comprising a steam turbine being drivingly connected to a generator, the improvement comprising
  - feeding part of the cement raw mix in pulverized form,
  - designing the cyclone system so as the lime-rich fly ash obtained from calcination of limestone from the pulverized part of the cement raw mix escapes the cyclone system,
  - feeding the predominant part of the remaining part of the cement raw mix in crushed form for forming bed and circulating material,
  - and grinding the hot bed material as well as additives before blending them with lime being separated in the filter, separated in the filter, obtained from calcination of limestone in the cement raw mix.
2. A process according to claim 1, wherein the discharged hot bed material is cooled before grinding.

3. A process according to claim 1, wherein the calcined pulverized lime escaped from cyclone (8) and separated in filter (37) is supplied to the clinkering process.
4. A process according to claim 1, wherein carbon contained in the fly ash escaped from cyclone (8) and separated in filter (37) and the carbon added via discharged hot bed material (11) is supplied to the clinkering process as a fuel.
5. A process according to claim 4, wherein the total amount of combustible material needed for the clinkering process is controlled in function of the carbon added via filter (37) and the carbon added via discharged hot bed material (11)..
6. A process according to claim 4, wherein the amount of combustion air needed for the clinkering process is controlled in function of the additional carbon separated in the filter (37) and the carbon added via discharged hot bed material (11).
7. A process according to claim 3, wherein part of the calcined pulverized lime escaped from cyclone (8) and separated in filter (37) is re-injected into line 32 upstream the filter (37) to improve sulfur removal efficiency by simultaneously controlling the relative humidity in the flue gas.
8. A process according to claim 1, wherein the calcined raw mix is preheated before entering the clinkering process.
9. A process according to claim 4, wherein the gas and the fly ash escaping the cyclone and entering the steam producer (33) are cooled at a fast rate in order to avoid recarbonation of lime.

10. A process according to claim 1, wherein the exhaust gases from the kiln (16) and the cyclone (53) are added to the gases exhausting the CFB cyclone (8) in order to match pressure conditions.
11. A process according to claim 1, wherein the predominant portion of the sensible heat in the clinker exiting the clinkering process is used for generating steam.
12. A process according to claim 1, wherein part of the flue gas discharged from clinkering process is passed through a scrubber (49), wherein gypsum  $\text{CaSO}_4$  is produced.
13. A process according to claim 1, wherein the at least one heat exchanger is utilized for preheating air being fed to the bed as fluidizing air and overbed air.
14. A process according to claim 1, wherein the at least one heat exchanger is a steam producer (33) followed by an air heater (28).
15. A process according to claim 1, wherein the part of the cement raw mix fed in pulverized form into the circulating fluidized bed (1) is the predominant part.



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/CH 00/00493

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 C04B7/45 F22B31/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CH 689 830 A (LUZIUS ZAPPA) 15 December 1999 (1999-12-15) whole document	1
A	US 5 216 884 A (HOLSIEPE DIETMAR) 8 June 1993 (1993-06-08) column 2, line 21 -column 4, line 10	1
A	DATABASE WPI Section Ch, Week 199231 Derwent Publications Ltd., London, GB; Class L02, AN 1992-257351 XP002132235 & SU 1 675 254 A (CEMENT IND RES INST), 7 September 1991 (1991-09-07) abstract	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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